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The PEACE Program is designed to assist Program/Item Managers allocate fixed resources between end-item procurement and investment in industrial preparedness measures (IPMs). This allocation will maximize total inventories available to the combat theater commanders in some future conflict. While the program was developed for the Department of the Army, it is a generic program that could be used by any DoD Service or agency responsible for procuring major end items of equipment, munitions, or secondary items.

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The PEACE *Program*

Production Expansion/Acceleration Capability Enhancement

Developed for
the Department of the Army

by the
Logistics Management Institute

Salvatore J. Culosi
David P. Garner

March 1992

THE PEACE PROGRAM

THE PEACE PROGRAM

PREFACE

This users guide describes prototype software developed for use on an IBM-compatible personal computer (PC). Best results will be obtained using an Intel 80386 processor and a compatible math co-processor. The software has been subjected to limited testing under the direction of the program developer. Extensive testing, however, is required to refine the design further and to solicit recommendations from the field that will improve functionality.

Any suggestions you have for improving the program or any errors you uncover should be directed to the Logistics Management Institute's PEACE Project Leader who can be reached at (301) 320-7368

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THE PEACE PROGRAM

Chapter 1

Introduction

CHAPTER 1 - INTRODUCTION

The Production Expansion/Acceleration Capability Enhancement (PEACE) Program is designed to assist Program/Item Managers allocate fixed resources between end-item procurement and investment in industrial preparedness measures (IPMs). This allocation will maximize total inventories available to the combat theater commanders in some future conflict. While the program was developed for the Department of the Army, it is a generic program that could be used by any DoD Service or agency responsible for procuring major end items of equipment, munitions, or secondary items.

The prototype program permits the user to calculate options for spending available resources based on relatively limited amounts of data for a specific item and its components. The program also allows evaluation of these spending options against conflict scenarios and performance of "what if" analyses.

1.1 INSTALLING THE PROGRAM

To run the program, you need an IBM-compatible personal computer (PC) with 640k of memory and a hard disk drive. The program will run with an Intel 80286 processor but runs best using an Intel 80386 processor and a compatible math co-processor. A full-color monitor is recommended although the program will work with a green or amber monitor.

The program and example data bases are stored on the floppy disk provided with this guide. (See Figure 1-1.) Make a copy of the floppy disk and store it in a safe place as a backup. To install the program on your hard disk drive, insert the program disk into your floppy drive (we assume that this is the **A** drive). Type **A:INSTALL** and press the **<Enter>** key. Bolding indicates information that is input into the computer (i.e., **A:INSTALL**) or instructions for proceeding (i.e., **<Enter>**).

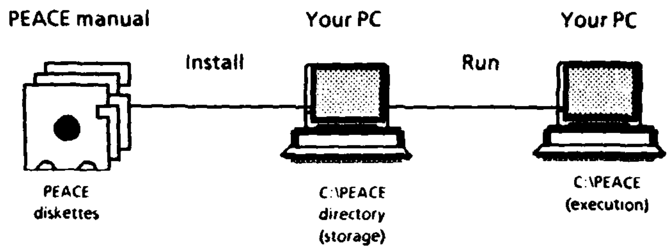


Figure 1-1. Program Installation

The installation program will create a subdirectory called "**PEACE**" on your hard drive and will copy the PEACE program, supporting programs, and data files to that subdirectory. Once the installation is complete, you will get the hard drive prompt **C:\PEACE** and you will be ready to start the model.

1.2 PEACE AT A GLANCE

The PEACE program allocates fixed resources between end-item procurement and investment in IPMs. This allocation will maximize total inventories available to the combat theater commanders for some future conflict. While the program can be used to assess the adequacy of the total funding available for a specific item and to compare relative support among items, it was not designed to determine the relative priorities for funding across items. It allocates the resources provided to the project to maximize combat capability for a given set of assumptions and input data.

Chapter 1 – Introduction

Version 1.4, the current program, is a prototype that is intended to serve as a test of principle and to elicit critical comments on the functionality of the program. As a result, the program is not yet as "user friendly" as one would expect for a full production program. We plan to improve both the functionality and human interface aspects of the program in the next release.

Each run of the program addresses a single commodity (weapon system, ammunition, or secondary item). Input data files for each commodity that must be created by the user are created within the model as one of several options. All data are input through the program; no other external data files are required.

Once the data have been developed, the user directs the program to build the optimum IPMs for an assumed warning period of 1, 2, 3, or up to 24 months. These 24 optimum solutions are stored and are available for the user to select through program options that present the results. The user can see:

- The allocation of the fixed resources between end-item procurement and IPMs. The IPMs are presented in terms of procurement for equipment to increase production capacity and/or procurement of long-lead components.
- The production expansion capability with and without the selected IPMs.
- The total post M-Day inventories over time with and without the IPMs.
- The sustainability that would result from implementing the proposed IPMs as a function of alternative warning assumptions.

The user can bring forward the relevant results and conduct "what if" analyses within minutes using an IBM-compatible Intel 80286 PC. The analysis portion of the model will run in seconds on an Intel 80386 processor with a compatible mathematics co-processor.

1.3 TO START

To run the program, type **PEACE** at the **C:\PEACE** prompt; then press <**Enter**>. The title screen will appear with no instructions. To continue, press <**Enter**> again and the Main Menu will appear. You are now ready to run the program.

1.4 MAIN MENU

The PEACE program uses a menu tree structure to navigate the program. The Main Menu options lead to other options in a descending hierarchy. The specific Main Menu options are shown in Figure 1-2.

PRODUCTION/EXPANSION/ACCELERATION CAPABILITY ENHANCEMENT (PEACE) MODEL

1. Identify File For Item Analysis
2. View or Modify Input Data
3. Build Industrial Preparedness Measures
4. View Results
5. Exit Program

Indicate Your Choice (1 - 5) 5

NOTE: Press **ESC** Twice To Exit From ALL Screens.

Figure 1-2. PEACE Main Menu

Option 1 is described in the next section. Option 2 is described in Chapter 2 – Program Input, which presents information on how to build, modify or view input data; Option 3 is addressed in Chapter 3 – Running the Program; and Chapter 4 – Program Output, addresses Option 4. Option 5 should be selected to exit the program.

1.5 THE PROGRAM DATA BASE

The first step in running the program is to build a data base or identify an existing data base to be used in running the program. Option 1 from the Main Menu serves this purpose and allows the user to:

- Give a name to a data base that will be created using the Main Menu Option 2
- Specify the name of the starting input data files for the model
- Specify the name of the new set of input data files that the user may elect to create in this run of the model.

In order to exercise Option 1, you must enter **1** and then press <**ESC**> twice. The prompt message shown in Figure 1-3 will appear on the screen with a blinking cursor (shaded in Figure 1-3).

```
Input Designation For Input File for Item - i.e., M430BAS
Use no more than 8 characters with no blanks
Existing file names are listed below:
M430BAS     M430EXC     M900BAS     PEACE     M900EXC
SADBAS
```

Figure 1-3. Prompt Screen for Input Data

Enter the name of the data file you want to build (it may have a maximum of 8 characters). The prompt provides a list of all the data files that have already been created. Select one of these as the point of departure for your current work session. If you wish to create a new data base from scratch, enter the name of the new data base. After entering the name, press the <**Enter**> key. At this point the program will append to the prompt in Figure 1-3 a request for the name of the output file (see Figure 1-4).

```
Input designation For Input File for Item  -  i.e., M430BAS
Use no more than 8 characters with no blanks.
Existing file names are listed below:
M430BAS      M430EXC      M900BAS      PEACE      M900EXC
SADBAS
M430BAS
Input designation for Output File for Item - i.e., M430EXC
 Use no more than 8 characters with no blanks
```

Figure 1-4. Prompt Screen for Name of Output Files

In Figure 1-4, two items are highlighted:

- M430BAS – this is the name of the file that was selected in the preceding prompt: and

- The blinking cursor.

Enter the name of the file that will contain the result of your work for this run of the model; again, use no more than 8 characters. You may select the name of a data base that already exists but you will lose all the information in that data base; the results from the current work session will over write this file. If you are creating a new data base from scratch, enter here the same name you entered in response to the previous prompt. After entering this information, press the <**Enter**> key.

If you should skip the use of Option 1 from the Main Menu and instead attempt to exercise Option 2, 3, or 4 before designating an input file, the program will know this and will ask you for the name of the input data files before proceeding to exercise the option you have chosen.

Chapter 2
Program Input

CHAPTER 2 - PROGRAM INPUT

This chapter discusses the process for building, viewing, or modifying all the input data for the weapon system, ammunition, or secondary item. This program input option is invoked by selecting and entering "2" from the Main Menu (see Figure 1-2). When this option is selected, the screen shown in Figure 2-1 will appear. If you have not already indicated the name of the input data files using Option 1 (see Section 1.5), you will be prompted with the screens shown in Figures 1-3 and 1-4.

VIEW OR MODIFY INPUT DATA

1. End-Item Information And Available Resources
2. Component Information
3. Conflict Scenario Information
4. Return To Main Menu

Indicate Your Choice (1 - 5) 4

Figure 2-1. Input Screen Menu

This chapter defines the data elements required for the three input data options shown in Figure 2-1. (Selection of Option 4 returns the user to the Main Menu.)

2.1 END-ITEM RESOURCES, INVENTORIES, AND PRODUCTION INFORMATION

Figure 2-2 reproduces the entire input screen that you have access to when **Option 1** is selected from the Input Screen Menu. It presents the required inputs for the end item under analysis, except for the detailed component data to be addressed in the next section. In Figure 2-2, the data elements required as input by the user are bolded.

Chapter 2 – Program Input

Name of End Item: **40mm Grenade M430**
Average Unit Cost:

Average Unit Cost (UC) depends on Cumulative Quantity (CQ) using the following equation: UC = A*Log (CQ) + B. "A" and "B" are determined so that the following two data points input by the user lie on this curve:

	UC	CQ	
	12.810 = A*Log	2411	+ B
	12.860 = A*Log	1858	+ B

Funding By Year: Procurement Time Horizon For This Analysis (Years): 3

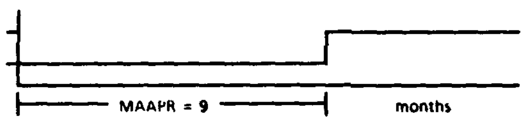
FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	FY-99
23894.8	30882.7	29464.8	34174.0	37334.4		

Applicable Inventory When Prior Year Programs Deliver: 5146
Annual Losses: Peacetime 1700 Mobilization 0
Process Flow Time (months): 0
Monthly Production Capacity of Physical Plant:

Input:

MAPC = 3735.

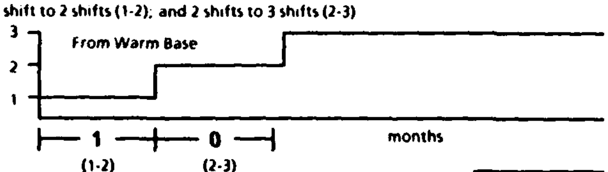
MCPC = 1645.

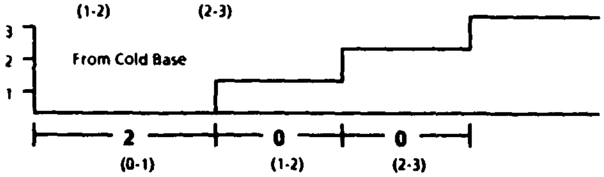


- Ainv = Cost to go from MCPC to MAPC = 1710
- MCPC = Maximum Current Production Capacity with current "brick & mortar" and equipment unconstrained by labor and materials
- MAPC = Maximum Attainable Production Capacity with Additional Investment for "B&M" and/or equipment (Ainv)
- MAAPR = Months to Attain the Additional Production Rate with indicated investments for "B&M" and/or equipment

Prime Contractor's Labor Lead Time:

Input the time it takes to hire and train people in order to increase # of production shifts from: cold base to single shift (0-1), single shift to 2 shifts (1-2); and 2 shifts to 3 shifts (2-3)





Number of Critical Components (< 11): 5
Max Lead Time On Other Components (months): 1
Share Sub-Component Equipment Cost With Common Users (Y or N): Y

Figure 2-2. End-Item Input Screen

Since all of Figure 2-2 cannot be seen on the monitor at one time, the user must use the **Pg Dn**, **Pg Up**, and the **up**, **down**, **left**, and **right** arrow keys to read all of the screen. <**Enter**> and <**TAB**> keys move the user to the next data element. The <**Home**> key brings the user to the top left corner of the screen. When finished entering the data for this screen, the user must press <**ESC**> twice.

The following sections will address parts of the input screen shown in Figure 2-2. At the beginning of each section, we will reproduce and highlight the portion of Figure 2-2 that will be discussed in the section. For the most part, there is sufficient description of the input data on the screen. The following sections duplicate and expand on this information as necessary.

2.1.1 Name, Costs, Resources, Inventories, and Losses

Figure 2-3 highlights the data elements of Figure 2-2 to be addressed in this section.

For the "Name of End Item," use any set of characters to describe this item.

The program models unit cost as a function of cumulative quantity produced. The unit cost is assumed to be proportional to the logarithm of the cumulative quantity. By specifying two data points on this curve, the program solves for the two constants "A" and "B" and uses the resulting curve to pick off the unit cost for the quantity actually procured over time.

Chapter 2 – Program Input

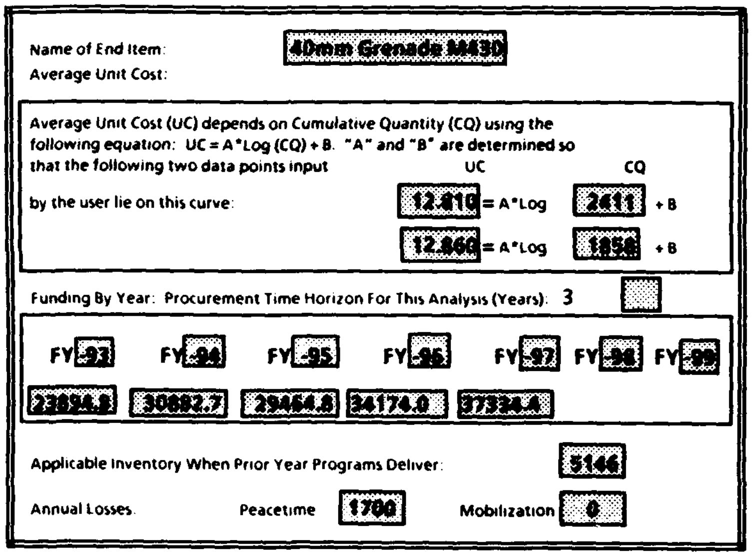


Figure 2-3. Name, Costs, Resources, Inventories, and Losses

The inputs are unit cost (UC) and cumulative quantity (CQ). At this point in the program, you must decide on the units that you will be using. Since the spaces for input are limited, the user must decide if the data on the item will fit. For example, if the actual units are millions of items, the user might decide to input the data in thousands. Thus, the cumulative quantity and all other quantity data must be in the same units.

Because the program allocates fixed resources between end-item procurement and investments in IPMs, these inputs are required:

- The time horizon in years for the analysis, which is set to "3" in this example.
- The fiscal years under consideration. In this case, the user inputs are 93, 94, . . ., 99 to reflect FY93 through FY99.

- The resources available for allocation over these years. Units are controlled by the user. In this example, the UC information is in dollars but the CQ is in thousands. As such, the cost data here under the FY9? should be in units of thousands of dollars. All dollar inputs thereafter will be in thousands of dollars except the unit price information which will be in the same units as the unit price information supplied above.

When inputting resources available for allocation, the user must be aware of the following limitations of the current model.

- Inflation is not addressed. All costs are assumed to be in constant dollars.

- The model assumes that the fixed cost in each year is zero.

Thus, input resources should be in constant dollars (no inflation) and should exclude known fixed costs in each year. The development of a total procurement program would require that the fixed costs be added to each year and the results inflated using the appropriate inflation indices for each year.

In Figure 2-3, the number "3" for the time horizon has the following significance:

- The program will use the resources listed for the first 3 years.

- Mobilization is assumed to occur on the first day after the end of the FY95-funded delivery period (FDP) or 3 years into the program listed.

The "Applicable Inventory When Prior Year Programs Deliver" is the inventory that will exist at the end of the FY92-funded delivery period. The example in the figure shows FY93 and beyond. If the funded delivery period for FY92 is 2 years beyond the fiscal year, then the asset posture will be that projected for 30 September 1994.

The last two data elements highlighted in Figure 2-3, annual losses during peacetime and during mobilization prior to D-Day, are used to obtain projections of inventories throughout the time horizon under consideration and during mobilization. The program adds end items procured in FY93 through FY95 and subtracts peacetime losses to obtain the asset posture at the beginning of mobilization that is assumed will occur at the end of the FY95 FDP in this example. Mobilization losses are used to calculate the D-Day inventory depending on the user-specified input for industrial warning. (Industrial warning is explained in Chapter 4.)

2.1.2 End-item Process Flow Time and Monthly Production Capacity of the Physical Plant

Figure 2-4 highlights the data elements that will be discussed in this section.

"Process Flow Time" is the time in months that it takes to produce the end item, independent of the availability of labor and materials. It is a function of the process and the equipment that is used to put the end item together. For a submarine, this might be 84 months. An aircraft might require as long as 18 months to build. On the other hand, the flow time for an ammunition item might be measured in days.

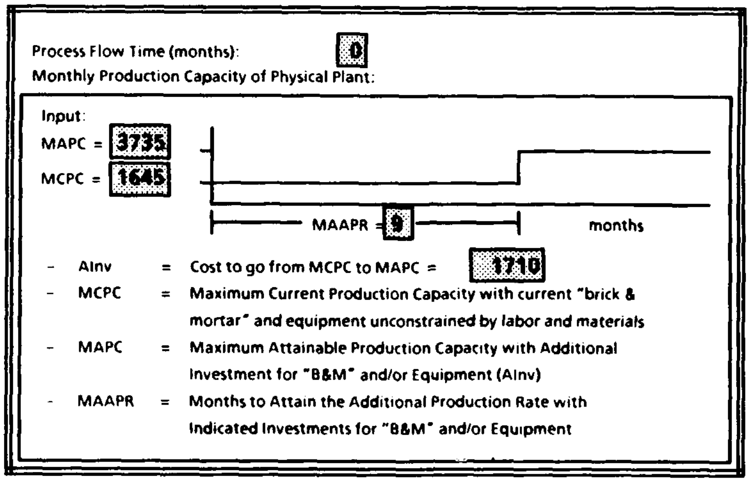


Figure 2-4. Flow Time and End-Item Production Capacity

The four numbers labeled MCPC, MAPC, MAAPR, and AInv describe the production capacity of the physical plant. These data are independent of the availability of labor and materials; that is, they assume that we have sufficient labor and materials.

- MCPC is the maximum, current, monthly production capacity of the existing plant. In this example MCPC is 1,645,000 units per month.

- MAPC is the maximum, attainable, monthly production capacity that could be in place within MAAPR months if AInv dollars were invested in equipment or additional facilities. The data indicate that we can increase total monthly production capacity from 1,645,000 a month to 3,735,000 per month within 9 months by obligating $1,700,000 for that purpose.

2.1.3 Prime Contractor's Labor Lead Time

Figure 2-5 highlights the data elements that will be discussed in this section.

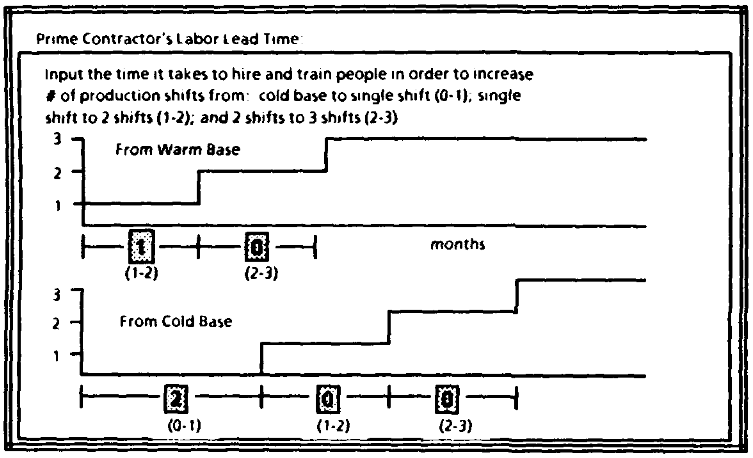


Figure 2-5. Prime Contractor's Labor Lead Time

The contractor's labor lead time is modeled with five parameters highlighted in Figure 2-5. The first two define the labor lead times when the production line is operating on a single 8-hour shift, 5 days a week (a 1-8-5 shift):

- The first highlighted "1" above "(1-2)" under "From Warm Base" means that it would take 1 month to hire and train the required personnel to go from 1 shift to 2 shifts a day. This assumes that material and physical plant capacity are sufficient to allow this increase.

- The highlighted "0" above "(2-3)" is the additional time it would take to hire and train sufficient labor to go to 3 shifts. Because the number is zero, it means that it would take only 1 month to acquire sufficient people to go from 1 shift to 3 shifts.

The next three numbers are similar parameters for a cold production line. The data in Figure 2-5 indicate that it would take 2 months to hire and train sufficient labor to operate 3 shifts if we had no labor at the start of the process. That is, it would take 2 months to get the first shift and additional zero months to get the other 2 shifts which essentially says that all 3 shifts can be provided in 2 months.

2.1.4 Critical Components and Cost Sharing Indicator

Figure 2-6 highlights the data elements that will be discussed in this section.

Number of Critical Components (< 11) 5
Max Lead Time On Other Components (Months) 1
Share Sub-Component Equipment Cost With Common Users (Y or N) Y

Figure 2-6. Critical Components and Cost Sharing Indicator

The program models the entire end item as the sum of the number of critical items specified by the user (the first parameter highlighted in Figure 2-6) and one pseudo item that represents all the remaining components. Currently, the program can handle at most 10 critical components. The example in Figure 2-6 indicates that there are 5 critical components for this item. The data elements for the 5 critical components are defined in Section 2.2.

The second highlighted data element in Figure 2-6 is the maximum lead time for all the other components. The value "1" indicates that we can get as much as we want of the components not addressed in the program within 1 month.

The last data element in Figure 2-6 indicates whether the total costs to increase production capacity for common components will be shared by all users. Since some components are shared by different end items, we offer the user the option of sharing these costs or absorbing them all. The case for absorbing all costs can be made if there is no procurement for the other end item and therefore no basis for realistically assuming that the other end item can in fact share these costs. On the other hand, the Army as Single Manager For Conventional Ammunition, may be the agent responsible for the production base facilities and should absorb all the costs. A switch is provided to perform "what if" analyses in those cases where the choice is not as clear as one would like.

2.2 CRITICAL COMPONENT DATA

The user can build, view, or modify component data by selecting Option 2 from the Input Screen Menu shown in Figure 2-1. Selection of Option 2 from this screen will display the screen shown in Figure 2-7. Figure 2-7 shows the data elements that are required for the first of five critical components. The screen in Figure 2-7 cannot fit on the monitors, so the user must view the screen using the cursor movement keys. When you are finished entering the data for this screen, you must press the <**ESC**> key twice.

The first four data elements are discussed below:

- Insert the name of the component in the space indicated.

- This is followed by the unit price. Here we make no provision for varying unit price as a function of quantity produced.

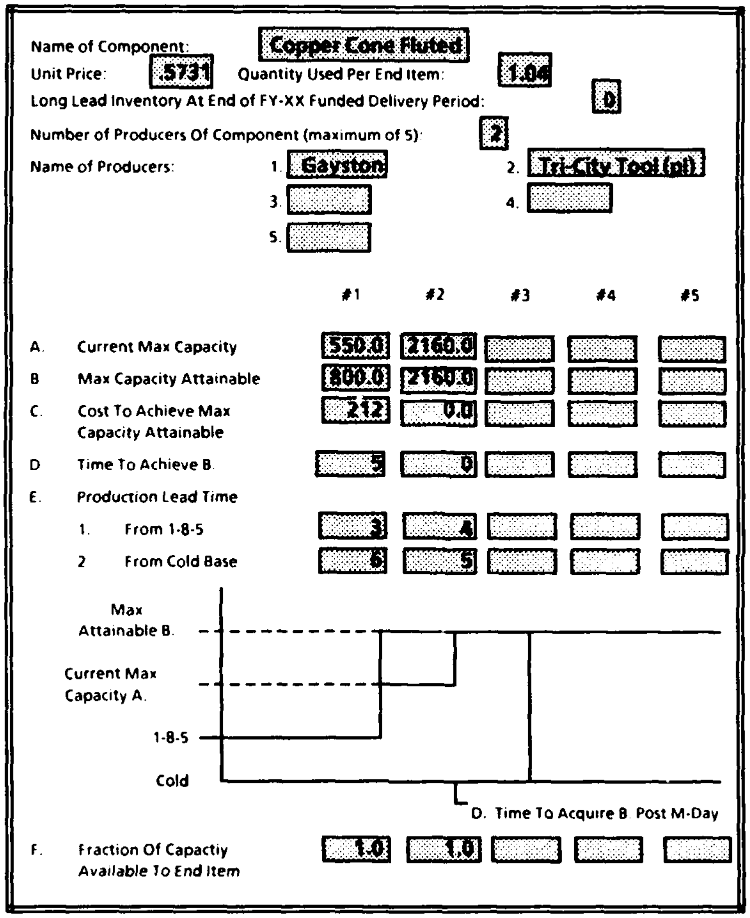


Figure 2-7. Input Data for Components

- "Quantity Used Per End Item" indicates how many of the component must be produced for each end item. This number accounts for quality control and breakage as well as quantity per application. If we need 82 grenades for the 155-in. ICM round, and spoilage is 4 percent, then the number used here would be 85.28 (82 x 1.04).

- "Long-Lead Inventory . . ." is the number of long-lead items procured in prior years that can be applied to the outyear procurement. In this case, the zero means that none were available from prior year procurements.

The next data element indicates the number of producers as "2" entered in this example. The display and the program allow for a maximum of 5 producers. This is followed by the names of the producers. For the Copper Cone Fluted component, Gayston and Tri-City Tool (a planned producer) are the producers.

For each of these producers, we need to input the production capacity information specified by data elements A through F. These elements are comparable to those for the principal end item discussed in Section 2.1.2:

- **Data element A** is the maximum current capacity of each producer. This parameter takes into account the availability of labor and materials to the subcomponent producer during a crisis period.

- **Data element B** is the maximum capacity attainable within the months specified by data element D for the cost specified by data element C.

- **Data element E.1.** is the time it would take to produce maximum output for each producer when operating on a 1-8-5 shift.

- **Data element E.2.** is the time to maximum capacity when the producer starts cold.

- **Data element F** is the fraction of the total production capacity of this producer that is earmarked for this end item. In the example, all production from Gayston and Tri-City Tool would be allocated to the 40mm Grenade.

After you have entered the data for the first component and have pressed <**ESC**> twice, you will be prompted by the screen in Figure 2-8 which asks if you wish to proceed with component 2. If you wish to continue, input <**Y**> at the blinking cursor (shaded) and press <**Enter**>; the screen for the next component will appear. If not, enter <**N**> and you will be returned to the Input Screen Menu (Figure 2-1).

```
Continue Viewing Component Data (Y or N) [ ]
```

Figure 2-8. Prompt Screen for Additional Component Data

2.3 CONFLICT SCENARIO INFORMATION

The user can build, view, or modify conflict scenario information by selecting Option 3 from the Input Screen Menu shown in Figure 2-1 which will display the screen shown in Figure 2-9. This screen shows the data elements that are required for each of the three scenarios. Again, the screen in Figure 2-9 cannot fit on the monitor; so, the user must view the screen using the cursor keys. When you are finished entering the data for this screen, you must press the <**ESC**> key twice.

Conflict Scenarios:

Conflict 1 - MRC(E)
Number of 10-day periods 9

Combat Demands

1-10	11-20	21-30	31-40	41-50
2500	2500	2300	1800	1400
51-60	**61-70**	**71-80**	**81-90**	**91-100**
1200	1100	800	500	

Conflict 2 - MRC(W)
Number of 10-day periods 6

Combat Demands

1-10	11-20	21-30	31-40	41-50
2500	2000	1300	900	600
51-60	**61-70**	**71-80**	**81-90**	**91-100**
500				

Conflict 3 - MRC(Europe)
Number of 10-day periods 9

Combat Demands

1-10	11-20	21-30	31-40	41-50
3000	3000	3000	2500	2400
51-60	**61-70**	**71-80**	**81-90**	**91-100**
2400	1300	1300	1000	1000

Build Conflict Scenario:

Indicating the sequence of conflicts and the time (in days) when the second conflict begins relative to the first

- First conflict (1-3) 1
- Second conflict (0-3; 0 = no second conflict) 3
- Offset of 2nd conflict relative to 1st (days) 60

Figure 2-9. Conflict Scenario Data

This screen requires that the user specify the combat consumption demands, in 10-day increments, for each of three planning scenarios: Conflict 1 – MRC (E), Conflict 2 – MRC (W), and Conflict 3 – MRC (Europe). It requires that the user specify the number of 10-day periods for each conflict followed by the combat losses in each period.

The last three data elements permit the user to specify the scenario against which capability will be assessed. The "1" means that the scenario begins with Conflict 1. The "3" means that the second conflict in the scenario is Conflict 3. The "60" means that the second conflict for the scenario (in this case Conflict 3) begins 60 days after the first conflict (which in this case is Conflict 1). Thus, if the three numbers were "3", "2", and "180", that would say the scenario to be evaluated would be one that begins with Conflict 3, followed by Conflict 2, 180 days after the start of Conflict 3.

Chapter 3
Running the Program

CHAPTER 3 - RUNNING THE PROGRAM

3.1 OVERVIEW

Option 3 from the Main Menu in Figure 1-2 executes the analysis portion of the program. This is the longest running portion of the program. With a large data base, the program could take as long as 15 minutes on an IBM-compatible Intel 80286 PC without a math co-processor. A program run of the same complexity would take less than 30 seconds with an Intel 80386 processor and compatible math co-processor.

Through a fairly exhaustive search process, the program selects the best series of industrial preparedness measures for each of 24 different assumptions for industrial warning time. Industrial warning time is varied from between 1 month ıd 24 months. These results are stored in the computer memory and are displayed by the user when Option 4 is selected. (This is discussed in Chapter 4.)

If the user attempts to execute Option 3 before Option 1, the program will prompt the user to provide the name of the input data files to be used. In this case, the program will provide the two prompts shown in Figures 1-3 and 1-4.

Once a data base has been identified, the program provides the self explanatory prompt in Figure 3-1. Normally, the user would input 1.0 and not constrain the program any further than that required to ensure there are adequate resources to support peacetime training.

Input Maximum FRACTION of Total Procurement That is
Permissible For IPM Investments In This Analysis

A Limit of **0.275818** Has Already Been Established To
Insure That We Procure More Than We "Lose" Annually

If This Is Too Large, Change It Below. If Not, Enter **1.0**
The Smaller Of The Two Will Be Used

Figure 3-1. IPM Threshold Parameter

However, there may be circumstances under which the program would attempt to allocate more resources to long-lead components than could be supported by the procurement programs beyond the time horizon specified in this analysis. (See Section 2.1.1 for a discussion of the time horizon parameter and the resource input values.) The results portion of the program will inform the user if this situation occurs. (See Section 4.2 and Figure 4-5.) If it occurs, the user may wish to further constrain the program to a lower fraction of the total costs for IPMs. The fraction of total costs allocated to IPMs for a particular run of the program is presented on the "results screen" described in Section 4.2 (Figure 4-2). When the prompt shown in Figure 3-1 appears, the user can input a smaller number and the program will further limit IPM investments.

After responding to the prompt in Figure 3-1, the user will get a prompt in the upper left corner of the monitor indicating that the program is processing. When processing is complete, the program returns the user to the Main Menu unless the user selected Option 4, in which case the user will be returned to the Results Menu, described in Chapter 4.

3.2 EXCURSIONS

If the user tries to execute Option 4 before Option 3, the program will know that the analysis portion of the program has not been executed and will proceed to execute Option 3.

However, the user must use caution when using Option 4 after Option 3 has been run. After Option 3 has been run, the program will only execute Option 3 if the user decides to use a new data base through input data requested by executing Option 1. Execution of Option 1 sets a flag that says that the execution of Option 3 must be completed before Option 4 (View Results) is invoked.

If the user changes data for an end item or the critical components through the use of Option 2 from the Main Menu (Figure 1-2) followed by Option 1 or 2 from the Input Screen Menu (Figure 2-1), the user must re-execute Option 3 to ensure that the results are consistent with these new data. (Changes to the combat consumption data do not require a re-execution of the analysis portion of the program.) If the user does not re-execute Option 3, the user will be viewing old results. We have built the prototype so that the user can return to view but not change data without requiring the model to execute a portion of the program that could take some time to run.

Chapter 4

Program Output

CHAPTER 4 - PROGRAM OUTPUT

4.1 OVERVIEW

Selecting Option 4 from the Main Menu in Figure 1-2 provides the user with the Summary of Results Menu shown in Figure 4-1.

SUMMARY OF RESULTS

Number of Months Of Industrial Warning To Be Assumed For Planning 14

1. "Optimum Mix" Of Total Resources Allocated To This End Item Under Indicated Warning Assumption;
2. Post M-Day Production Expansion Capability With & Without IPMs; And The Supplemental Funding Requirements During Mobilization
3. Total Inventories After M-Day With & Without IPMs;
4. A Comparison Of Sustainability Profiles Against The Input Scenario For Alternative Warning Periods:
   - Actual Warning = Planned Warning (above)
   - Actual Warning = 5 Months
5. Return to Main Menu

Indicate Your Choice (1 - 5) 5

Figure 4-1. Summary of Results Menu

This part of the program allows the user to view the results of the analysis made by the program. The key input variable in examining the results is the number of months of industrial warning to be assumed in the planning and programming process. This is the first data element on the screen in Figure 4-1. Changing this input value will influence all the summary results presented through the options selected from the Summary of Results Menu.

Chapter 4 – Program Output

After setting the assumed warning period, the user may execute Options 1 through 4 by entering the selection at thebottom of the screen and pressing <ESC> twice. Selection of Option 5 returns the user to the Main Menu. If Option 4 is selected, an additional piece of information is required as noted on the menu. This second data element is discussed in Section 4.5, "Sustainability Profiles."

4.2 OPTIMUM ALLOCATION RESULTS

Selecting Option 1 from the Summary of Results Menu presents the user with a series of four displays:

- Investments for Industrial Preparedness Measures (Figure 4-2)
- A breakout of long-lead component procurement (Figure 4-3)
- A breakout of end-item procurement (Figure 4-4)
- An assessment of "excess" long-lead procurement (Figure 4-5).

SUMMARY OF PROCUREMENT PROGRAM WITH PLANNED WARNING OF 14 MONTHS

40mm Grenade M430

	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	FY-99	TOTALS
Total $:	23894.8	30882.7	29464.8	0.0	0.0	0.0	0.0	84242.3

Total IPM Procurement Costs:

	Equipment	Long-Lead Comp.	Total IPM
Prime Contractor	0.	0.	0.
Copper Cone Fluted	0.	22.	22.
Cartridge Case M169	0	856.	856.
Fuze PD M549	0.	8465.	8465.
Link M16A2	0.	150.	150.
Shell HE DP M430	0.	1705.	1705.
Grand Total (IPMs):	0.	11199.	11199.

Fractional Limit of IPM Investments = 0.233
Fraction Of Total Procurement Spent On IPMs = 0.133
Hit <Enter> For A Proposed Breakout Of Procurement Of Long-Lead Components

Figure 4-2. Investments for Industral Preparedness Measures

SUMMARY OF LONG-LEAD PROCUREMENT WITH PLANNED WARNING OF 14 MONTHS

40mm Grenade M430

	Begin Inv	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	FY-99	End Inv
		Quantity Procured							
Copper Cone Fluted	0	6	18	13	0	0	0	0	37
Cartridge Case M169	0	157	414	307	0	0	0	0	878
Fuze PD M549	0	542	1429	1060	0	0	0	0	3031
Link M16A2	0	127	337	250	0	0	0	0	714
Shell HE DP M430	0	191	505	375	0	0	0	0	1071
Long-Lead Procurement $		2003	5278	3916	0	0	0	0	11198

Hit <Enter> For A Breakout Of 73043.6 $ For End-Item Procurement

Figure 4-3. Long-Lead Component Procurement

SUMMARY OF PROCUREMENT WITH PLANNED WARNING OF 14 MONTHS

40mm Grenade M430

	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	FY-99	TOTALS
Item $:	21891.0	25604.7	25547.9	0.0	0.0	0.0	0.0	72849 8
Items:	1700	2032	2045	0	0	0	0	5762
Unit $:	12.88	12.60	12.49	0.00	0.00	0.00	0.00	12.64

	M-Day	D-Day (M + 14)	War Reqmt
Inventories:	5822	17870	34000

Enter "P" For Previous Screen

OR

<Enter> For Assessment of Balance Long Lead Procurement And Outyear Funding

Figure 4-4. End-Item Procurement

The top of Figure 4-2 displays the total resources available for allocating to end items and IPMs. These data are not calculated by the program; they are the data input by the user in Figure 2-3.

SUMMARY OF "EXCESS" PROCUREMENT FOR LONG-LEAD COMPONENTS FOR AN ALLOCATION
BASED ON 14 MONTHS OF WARNING FOR 40mm Grenade M430

6688 To Be Procured In The Outyears

	Procurement			"Excess"
	Qty	/ $ /	End-Item Equiv.	
Copper Cone Fluted	37	22.	35	0.
Cartridge Case M169	878	856.	844	0.
Fuze PD M549	3031	8465.	2914	0.
Link M16A2	714	150.	686	0.
Shell HE DP M430	1071	1705.	1029	0.
Totals of Dollars		11199		0.

Enter "P" For Previous Screen
OR
<Enter> For Return To "Summary Of Results" Menu

Figure 4-5. "Excess" Long-Lead Procurement

Below this is a breakout of that portion of the total that has been selected for investment in IPMs. The table gives a breakout of IPM investments between equipment and long-lead components. Totals are summarized at the bottom.

Just below the table are two numbers:

- The limiting fraction of the total cost that could be spent on IPMs
- The fraction actually allocated to IPMs in this solution.

Instructions for proceeding to the next screen are at the bottom of the display.

Figure 4-3 presents the funding profile for long-lead components over the time horizon under consideration on the bottom line in the table. It also presents the numbers of long-lead components procured in each year and combines these totals with the beginning inventory to arrive at a total of long-lead components at the end of the last indicated funded delivery period. These data are required if the program is to be used in subsequent runs of the program. Recall that the starting asset position for long-lead components is required as input. (See Figure 2-7.)

Figure 4-4 shows the procurement profile for the end item along with the unit costs for each year and a total inventory procured. Below these data are some macro indicators of support capability:

- Total inventories on M-Day
- Total inventories on the assumed D-Day which is the number of months after M-Day that was indicated by the input warning assumption
- The total war requirement.

Figure 4-5 will identify, in the column labeled "Excess," any extra long-lead time component parts that may be procured that exceed the number of weapons in which they could be used. The last entry at the bottom of the "Excess" column is the "Excess" in dollars. In Figure 4-5 there are no "Excess" entries; they are all zero. Note that above the table is a statement that says "6688 To Be Procured In The Outyears." This means that there is sufficient funding in FY96 and beyond to procure 6688 more end items. Since all entries in the "End-Item Equiv." column are all less than 6703, there are no "Excesses."

4.3 PRODUCTION EXPANSION CAPABILITY

Option 2 from the Summary of Results Menu displays the monthly production that would result after M-Day with and without the IPM investments that were displayed using Option 1 above. The first display shows raw data. (See Figure 4-6.) As indicated in this display, a graph like that shown in Figure 4-7 can be obtained by entering "G".

PRODUCTION EXPANSION CAPABILITY WITH AND WITHOUT IPMs
(IPMs Based On Planned Warning Period Of 14 Months)

M +	W/O IPMs	WITH IPMs	M +	W/O IPMs	WITH IPMs
1	195	170	13	1011	1245
2	195	195	14	1011	1245
3	195	548	15	1011	1245
4	195	548	16	1011	1245
5	195	548	17	1011	1245
6	385	548	18	1011	1245
7	1011	1011	19	1443	1443
8	1011	1011	20	1443	1443
9	1011	1245	21	1443	1443
10	1011	1245	22	1443	1443
11	1011	1245	23	1443	1443
12	1011	1245	24	1443	1443

Enter "G" For Graph Of Data
OR
Hit <Enter> For Summary Of Supplemental Funding

Figure 4-6. Raw Data for Production Buildup Curves

Pressing <**Enter**> instead of <**G**> will take you to a summary of the supplemental costs that would be needed in the outyears in order to pay for the accelerated post M-Day production. This summary table is presented in Figure 4-8.

If the user selects "G" to display a graph of the production curves on the monitor, an option exists to produce a hard copy of the graph from the printer. If, after the graph has been displayed, you do NOT want a hard copy of the graph, press <**Enter**> without pressing any other key. In this case, the program will present the "supplemental" display shown in Figure 4-8. If you want a hard copy of the graph, type in any character string (preferably a note about the "case" for this graph), and then press <**Enter**>.

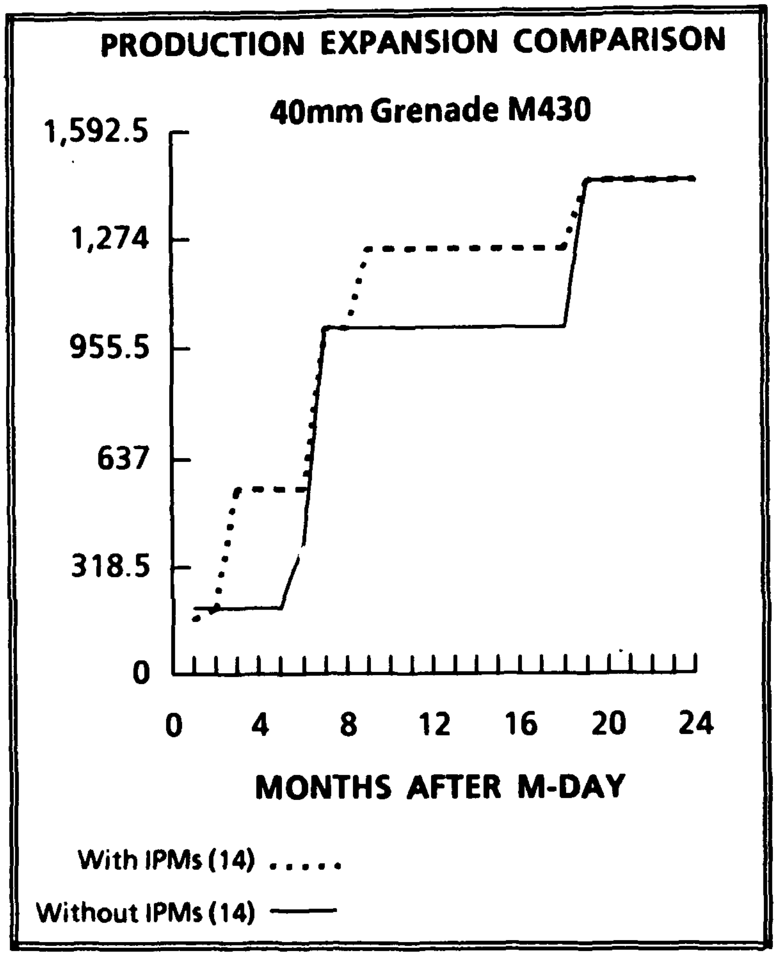


Figure 4-7. Graph of Production Buildup Curves

SUMMARY OF SUPPLEMENTAL PROCUREMENT
IN ADDITION TO THAT ALREADY PROGRAMMED FOR

40mm Grenade M430

IPMs BASED ON WARNING OF 14 MONTHS

		FY-96	FY-97
Programmed Funding:		34174.0	37334.4
Supplemental Required:			
-	With IPMs	83763.7	263643.1
-	Without IPMs	57404.6	232255.0

Enter "P" For Previous Screen
OR
Hit <Enter> To Continue

Figure 4-8 Supplemental Funding to Obtain Production Acceleration

4.4 POST M-DAY INVENTORIES

Option 3 from the Summary of Results Menu presents the raw data and the total growth in inventories after M-Day with and without the indicated investments in IPMs. These data do not show any losses; Option 4, discussed in Section 4-5, shows inventories over time as the assumed conflict unfolds. Figure 4-9 presents the raw data display. Figure 4-10 displays a graph of these data that is obtained by entering "G" as indicated by the message at the bottom of the display shown in Figure 4-9. See Section 4.2 for instructions to obtain a hard copy of the graph from your printer.

PRODUCTION EXPANSION CAPABILITY WITH AND WITHOUT IPMs
(IPMs Based On Planned Warning Period Of 14 Months)

M+	W/O IPMs	WITH IPMs	Delta	M+	W/O IPMs	WITH IPMs	Delta
1	6918	5992	-926	13	15155	16625	1469
2	7113	6186	-926	14	16166	17870	1703
3	7308	6734	-573	15	17177	19115	1937
4	7502	7282	-219	16	18187	20360	2172
5	7697	7830	133	17	19198	21605	2406
6	8081	8378	296	18	20208	22850	2641
7	9092	9389	296	19	21652	24293	2641
8	10103	10400	296	20	23095	25736	2641
9	11114	11645	531	21	24538	27179	2641
10	12124	12890	765	22	25981	28623	2641
11	13135	14135	1000	23	27425	30066	2641
12	14145	15380	1234	24	28868	31509	2641

Enter "G" For Graph Of Data Or Hit <Enter> For "Summary Of Results" Menu

Figure 4-9. Post M-Day Inventory Data

4.5 SUSTAINABILITY PROFILES

Selection of Option 4 from the Summary of Results Menu gives the sustainability profiles against the indicated scenario. For this option, the user can also assess the sustainability for alternative warning assumptions. These data entry requirements are shown under Option 4 in Figure 4-1. Thus, we can build an IPM using one assumption about warning and compare the results against two situations:

- The warning occurs as planned
- The actual warning differs from the planned warning and is equal to the user-specified input value next to "Actual Warning=" (see Figure 4-1).

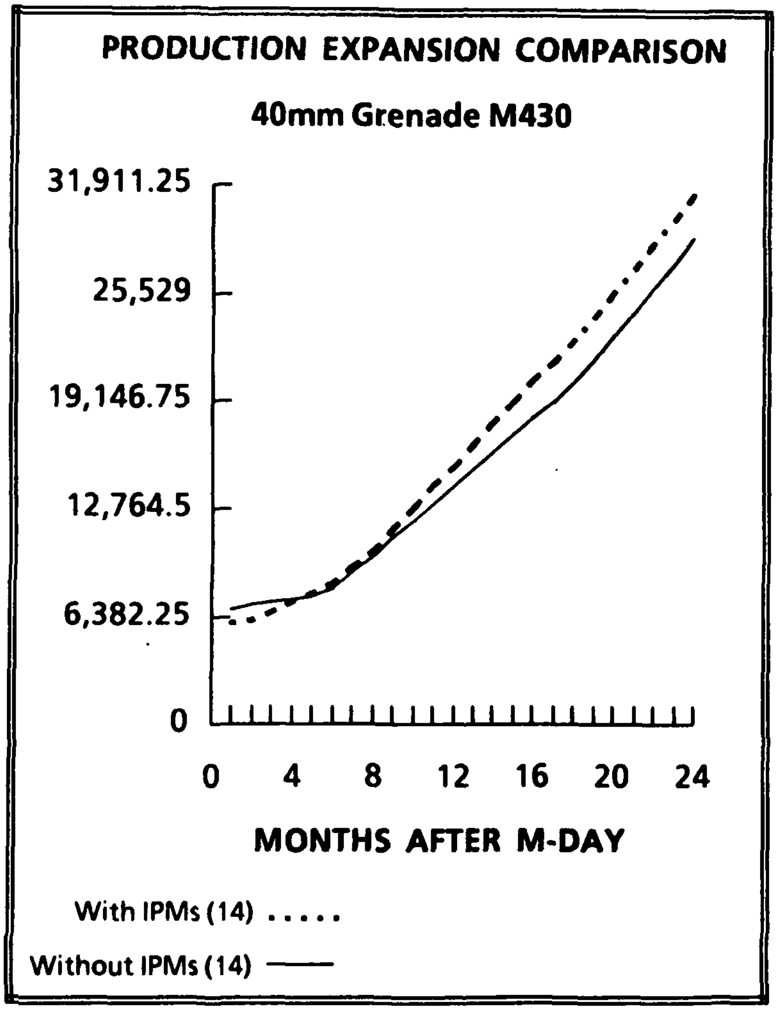


Figure 4-10. Graph of Post M-Day Inventories

Figure 4-11 shows the inventories over time after D-Day for both cases. Figure 4-11 also shows in the second column, next to the month indicator, the percent of the combat demands that could be supported for that case.

SUSTAINABILITY PROFILES AND INVENTORY BALANCES
OVER TIME WHEN ACTUAL WARNING IS

AS PLANNED (14 months)						ALTERNATIVE WARNING (5 months)					
D +	% Sust	Inv	D +	% Sust	Inv	D +	% Sust	Inv	D +	% Sust	Inv
1	100.0	11815	13		12987	1	100.0	1078	13		11205
2	100.0	8660	14		14430	2	24.5	1010	14		12648
3	76.0	1245	15		15873	3	8.9	1010	15		14091
4	17.1	1245	16		17316	4	13.8	1245	16		15534
5	34.6	1443	17		18759	5	34.6	1245	17		16977
6		2886	18		20202	6		2490	18		18420
7		4329	19		21645	7		3735	19		19863
8		5772	20		23088	8		4980	20		21306
9		7215	21		24531	9		6225	21		22749
10		8658	22		25974	10		7270	22		24192
11		10101	23		27417	11		8715	23		25635
12		11544	24		28860	12		9960	24		27078

Enter "G" For Graph Of Data Or Hit <Enter> For Results Menu

Figure 4-11. Sustainability Data

If "G" is entered, the user obtains a plot of the sustainability profiles for each of the cases. This is shown in Figure 4-12.

If you want to assess sustainability against a different scenario, exit the Summary of Results Menu, modify conflict scenario data (see Section 2.3), and then return to the Summary of Results (Option 4 from the Main Menu). Note that you do not need to re-run the analysis portion of the model (Option 3 from the Main Menu) to assess the capability of a specific allocation against alternative scenarios. However, this version of the model does not annotate the sustainability profile data with any information about the scenario being assessed. The user must keep track of this "off-line."

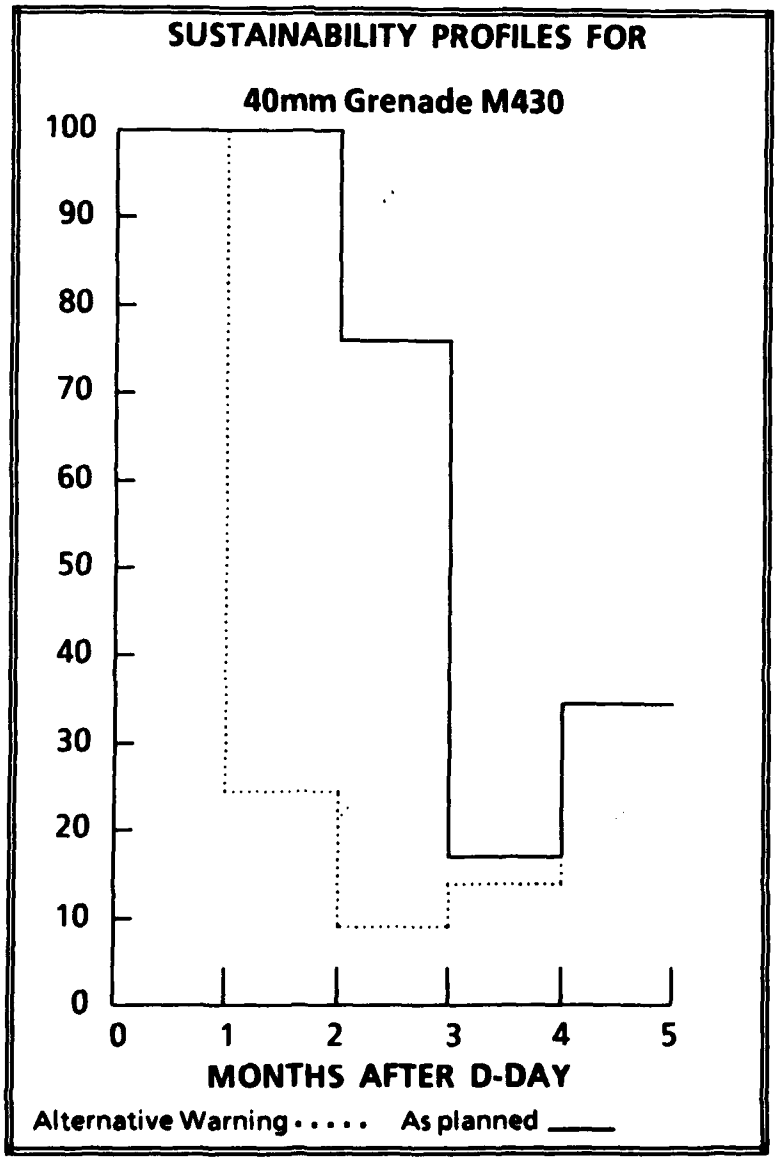


Figure 4-12. Sustainability Profiles

Chapter 5
Applications

CHAPTER 5 - APPLICATIONS

This chapter describes some ways to use the PEACE Program to address problems that cannot be modeled or addressed directly by the program in its current form. In the recent validation of the program conducted at Picatinny Arsenal, we came across a number of situations which would require substantial reprogramming. However, we were able to develop ways to address these problems using the current program design. Two of these areas are addressed below.

5.1 ANALYZING THE ROBUSTNESS OF WARNING TIME ASSUMPTIONS

The PEACE Program searches for the combination of procurement for end-items and investments on IPMs that maximizes total inventories at a specific point in time. That point in time is a function of two user-specified input parameters:

- The point in time when the industrial base for a specific item is asked to surge production to maximum capacity. This point in time is specified by the "time horizon" parameter (see Section 2.1.1) and is referred to as M-Day in the program.

- The number of months of industrial warning between M-Day and the start of a specified conflict.

The PEACE Program solves for the optimum solution for each of 24 industrial warning assumptions. Against this backdrop, we consider the following application of PEACE as a tool for assessing the robustness of solutions across conflicts.

Chapter 5 – Applications

The PEACE Program permits the user to consider three regional conflicts (see Section 2.3). Suppose Conflict 1 is assumed to occur first with little or no industrial warning (say 2 months) but Conflict 3 would occur with 15 months of warning. We could select the optimum solution for each warning assumption and then evaluate each of these programs against each of these scenarios to test the robustness of the solution. We could also evaluate each solution against a scenario that links both conflicts along a user-specified time line. In particular, we could examine the options presented in the following two paragraphs.

We can build a program that maximizes the total inventory at a point in time that is 2 months after mobilization (warning time is 2 months) and then evaluate the capability that we have in the following cases:

- Conflict 1 with short warning (2 months)
- Conflict 3 with long warning (15 months)
- Conflict 1 with short war (2 months) followed by Conflict 3 that begins 13 months after the start of Conflict 1.

Alternatively, we can build a program that maximizes the total inventory at a point that is 15 months after mobilization (warning time is 15 months) and then evaluate the capability that we have in the following cases:

- Conflict 1 with short warning (2 months)
- Conflict 3 with long warning (15 months)
- Conflict 1 with short war (2 months) followed by Conflict 3 that begins 13 months after the start of Conflict 1.

In this manner, the user can test the robustness of solutions as a function of industrial warning. We can build a program that supports a more demanding scenario that is likely to occur after long warning and test it to see if this program also satisfies the less demanding conflict that is likely to begin with no warning. Alternatively, we can build a program that supports a short war with no warning and test this solution against either a more demanding scenario that is likely to occur after long warning or a requirement to regenerate inventories.

The requirement to regenerate inventories can be simulated in the PEACE program by building a "pseudo conflict" that shows demands for replenishment assets over time.

5.2 MODELING COMPONENT PRODUCERS WITH MULTIPLE PRODUCTION LINES

The PEACE Program asks the user for production acceleration capability for the producers of critical components (see Section 2.2). The key inputs are the current maximum production capacity of the facility (within existing equipment and plant layout) and the production lead times for going from a 1-8-5 shift to maximum capacity. The model assumes that the 1-8-5 production rate for the facility is the current maximum production capacity divided by 2.5. We then ask for the number of months to accelerate from a 1-8-5 production rate to a maximum 3-8-6 production rate and the months to get to maximum capacity when the line is cold. The program then interpolates between these figures to arrive at production lead times.

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If there is a production factory or plant that is only operating one of five production lines, the current PEACE Program could understate the production response capability of that plant. As currently designed, the program will see only 20 percent of the 1-8-5 production capacity in operation. In this example, the one line would accelerate to maximum capacity in say 6 months, but the remaining four production lines may get to maximum capacity in 9 months. The current program is not designed to handle, in a direct way, this change in production response time for the active and inactive lines. It can, however, address this problem in an indirect way. To do this, we divide the production facility into two facilities and pretend that we have two producers of the item:

- The first producer consists of one production line with production response data for that production line.

- The second consists of a "pseudo production" facility with four production lines that are essentially cold and will have a production response capability that is consistent with their being cold but in a plant and management structure that is operating one active line.

The response capability for these four production lines would be better than that for a totally different producer who is really cold with no management structure and no vendor base to use as a springboard.